JP-5-210049. Applicants request that the Examiner issue a new Notice of References Cited form correcting the listing of these citations.

To place the subject application in better form, the specification has been amended to correct minor informalities, including those noted by the Examiner. Also, a new abstract is presented in accordance with preferred practice. No new matter has been added by these changes.

Claims 1-15 are presented for consideration. Claims 1, 12 and 15 are independent. Claims 1, 2, 4-8, 12, 14 and 15 have been amended to clarify features of the invention. Support for these changes can be found in the application, as filed. Therefore, no new matter has been added.

Applicants note that the Examiner has made final the restriction requirement previously set forth. Claims 12-15, withdrawn from consideration, have been retained in this application in order to preserve Applicants' rights. Applicants request that the Examiner contact their undersigned representative should it be necessary to cancel these claims in order to advance the subject application to issue.

Applicants request favorable reconsideration and withdrawal of the objection and rejections set forth in the above-noted Office Action.

The drawings were objected to on formal grounds. The Examiner inquired as to the operation of the pressure sensor 20 with respect to the chamber 14 and the projection optical system 13. As shown in Figure 1, and now presented in independent claim 1, a value of pressure inside the projection optics unit 13 is measured by the pressure sensor 20. Applicants submit that

one having ordinary skill in the art would readily understand this operation when read in light of the subject disclosure.

Claim 2 was rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. To expedite prosecution, Applicants have amended claim 2 in light of the Examiner's comments. Applicants submit that these changes overcome this rejection. Such favorable indication is requested.

Turning now to the art rejections, claims 1-7, 10 and 11 were rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 6,266,133 to Osakabe in view of U.S. Patent No. 6,133,981 to Semba. Claim 8 was rejected under 35 U.S.C. § 103 as being unpatentable over this art combination and further in view of Japanese Patent Document No. 5-210049 to Aoki. Claim 9 was rejected under 35 U.S.C. § 103 as being unpatentable over the original art combination and further in view of U.S. Patent No. 6,356,338 to Arakawa.

Applicants submit that the cited art, whether taken individually or in combination, does not teach many features of the present invention as previously recited in independent claim 1. Therefore, these rejections are respectfully traversed. Nevertheless, Applicants submit that independent claim 1, as presented, amplifies the distinctions between the present invention and the cited art.

Independent claim 1 recites an exposure apparatus having an illuminating optics unit for irradiating a reticle, on which a predetermined pattern has been formed, with exposing light emitted from an exposing light source, a reticle stage on which the reticle is placed, a projection optics unit for projecting the predetermined pattern of the reticle onto a substrate, and a substrate

stage on which the substrate is placed. The apparatus includes at least one chamber for internally accommodating the illuminating optics unit, the reticle stage, the projection optics unit, and the substrate stage, first pressure control means for making pressure inside the projection optics unit higher than pressure outside the chamber and first correction means for correcting optical characteristics of the projection optics unit in accordance with a value of pressure inside the projection optics unit.

Applicants submit that the cited art does not teach or suggest such features of the present invention, as recited in independent claim 1.

Generally speaking, with regard to the present invention, in an exposure apparatus that uses exposing light having a light-emission spectral line that overlaps an absorption spectrum region of oxygen, an overall optical path of the exposing light is sealed. A projection optics unit inside a chamber is made higher than the pressure outside the chamber. As a result, atmospheric oxygen outside the projection optics unit can be prevented from penetrating the interior of the projection optics unit, thereby making it possible to perform exposure more reliably under oxygen-free conditions. Further, the best projected image can be obtained by correcting the optical characteristics of the projection optics unit in accordance with the value of the pressure inside the projection optics unit.

Applicants further submit that the cited art does not teach or suggest such advantages provided by the present invention.

The Osakabe patent discusses a pressure absorber which adjusts a differential pressure inside and outside of an enclosure, in order to maintain a gas-tight environment formed inside the

enclosure. Specifically, that patent discloses technology for transporting an apparatus safely, without being dependent on a change of environmental conditions such as temperature and pressure at the time of transportation. Accordingly, the device in that patent operates so that any change in environmental conditions may be canceled. Applicants submit, however, that the Osakabe patent does not teach or suggest reliably performing exposure under an oxygen-free condition, and correcting optical characteristics of a projection optics unit in accordance with a value of pressure inside an enclosure, in the manner of the present invention.

Applicants further submit that the remaining art cited does not cure the deficiencies noted above with respect to the Osakabe patent.

The Semba patent discloses a processing system provided with an apparatus which performs thermal processing, for example, to a wafer. In order to prevent atmosphere of the processing system from flowing into the exposure apparatus, the system maintains the inside of the exposure apparatus at a predetermined temperature atmosphere. The Semba patent, however, as with the Osakabe patent, likewise does not teach or suggest reliably performing exposure under an oxygen-free condition, and correcting optical characteristics of the projection optics unit in accordance with the value of pressure inside the exposure apparatus.

The Arakawa patent discloses a sub-system for exhausting a gas-like chemistry substance in a section at which an exposure apparatus and a coating/developing system connect. The Aoki document discusses providing contents which correct properties of projection optical lenses in accordance with controlled pressure inside the projection optical lenses. Applicants submit, however, that in that document, a pressure value inside the projection optical lenses is controlled

to be equal to an outside environment pressure. This pressure control operates so that the differential pressure of the lenses and the outside environment may be canceled. Applicants submit, however, that in this control operation, it would be impossible to generate an oxygen-free environment.

For the reasons noted above, Applicants submit that the other documents applied by the Examiner add nothing to the teachings of the Osakabe patent that would render obvious Applicants' present invention as recited in independent claim 1.

For the foregoing reasons, Applicants submit that the present invention, as recited in independent claim 1, as well as that recited in independent claims 12 and 15, is patentably defined over the cited art, whether that art is taken individually or in combination.

The dependent claims also should be deemed allowable, in their own right, for defining other patentable features of the present invention in addition to those recited in their respective independent claims. Further individual consideration of these dependent claims is requested.

Applicants further submit that the instant application is in condition for allowance. Favorable reconsideration, withdrawal of the objection and rejections set forth in the above-noted Office Action and an early Notice of Allowance are requested.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should be directed to our address listed below.

Respectfully submitted,

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SEW/eab

APPENDIX A

IN THE ABSTRACT

[The optical path of exposing light is sealed in its entirety inside a chamber, pressure inside the chamber is made higher than the pressure outside the chamber and the optical characteristics of a projection optics unit are corrected in accordance with the value of pressure inside the chamber. In an exposure apparatus using exposing light having a light-emission spectral line that overlaps the absorption spectrum region of oxygen, atmospheric oxygen outside the chamber can be prevented from penetrating the optical path of the exposing light, thereby making it possible to perform exposure under oxygen-free conditions. In addition, the optimum projected image can be obtained.]

-- An exposure apparatus includes an illuminating optics unit for irradiating a reticle, on which a predetermined pattern has been formed, with exposing light emitted from an exposing light source, a reticle stage on which the reticle is placed, a projection optics unit for projecting the predetermined pattern of the reticle onto a substrate, and a substrate stage on which the substrate is placed. The exposure apparatus also includes at least one chamber for internally accommodating the illuminating optics unit, the reticle stage, the projection optics unit and the

substrate stage, a first pressure control device for making pressure inside the projection optics unit higher than pressure outside the chamber, and a first correction device for correcting optical characteristics of the projection optics unit in accordance with a value of pressure inside the projection optics unit. --

IN THE SPECIFICATION:

Please substitute the paragraph beginning at page 1, line 8, with the following.

-- This invention relates to an exposure apparatus in which the exposing light used is short-wavelength ultraviolet light, especially, light emitted by a light source such as an excimer laser, a harmonic laser or a mercury lamp and having an emission spectral line that overlaps the absorption spectrum region of oxygen, to a semiconductor device manufacturing method that utilizes this exposure apparatus, and to a semiconductor device manufacturing plant in which this exposure apparatus is installed. --

Please substitute the paragraph beginning at page 3, line 3, with the following.

-- With an exposure apparatus that uses an F_2 excimer laser, on the other hand, the emission spectral line of the F_2 excimer laser beam overlaps the absorption spectrum region of oxygen. The serious problems that result are the aforementioned decline in transmittance ascribed to absorption of light by oxygen and the evolution of ozone. For example, the transmittance of an F_2 excimer laser in the atmosphere is actually on the order of 0.1 %/mm. It is

believed that the decline in transmittance is the result not only of absorption of light by oxygen but also of the effects [of] produced by the evolution of ozone. The production of ozone not only causes a decline in transmittance but may also contaminate the surface of optical members, which are used in the projection optical unit, owing to a chemical reaction between ozone and other substances. There is the possibility that such contamination will degrade the exposing capability of the exposure apparatus. --

Please substitute the paragraph beginning at page 7, line 4, with the following.

-- The present invention further provides a method of manufacturing a semiconductor device, the method comprising the steps of: placing a group of manufacturing equipment for performing various processes, inclusive of the above-described exposure apparatus, in a plant for manufacturing semiconductor devices; and manufacturing a semiconductor device by a plurality of processes using this group of manufacturing equipment. --

Please substitute the paragraph beginning at page 7, line 12, with the following.

-- The present invention further provides a plant for manufacturing a semiconductor device, comprising: a group of manufacturing equipment for performing various processes, inclusive of the above-described exposure apparatus; a local-area network for interconnecting the group of manufacturing equipment, and a gateway for making it possible to access, from the local-area network, an external network outside the plant, whereby information relating to at least one of the pieces of manufacturing equipment can be communicated by data communication. --

Please substitute the paragraph beginning at page 9, line 15, with the following.

-- As shown in Fig. 1, the exposure apparatus has an exposing light source 6, for emitting short-wavelength light, such as an F_2 excimer laser. Light emitted from the exposing light source 6 is reflected by a mirror 19 and uniformly irradiates a reticle 7, which has been placed on a reticle stage 15, via an illuminating optical member 12. --

Please substitute the paragraph beginning at page 10, line 5, with the following.

-- The illuminating optics unit, reticle stage 15, projection optics unit 13 and substrate stage 9 are accommodated within a chamber 14. At such time, the interior of the chamber 14 is filled nitrogen gas, which is one of the inert gases, and the interior of the chamber 14 is held at a value of a pressure higher than that of the pressure outside the chamber. The atmosphere within the chamber 14 is controlled by a pressure controller 2, nitrogen gas supply unit 3 and pump 1. --

Please substitute the paragraph beginning at page 11, line 11, with the following.

-- The reticle 7 is exchanged for another via a reticle load-lock chamber 7. This, too, means that there is no decline in throughput and no disruption of the atmosphere within the chamber

14. --

Please substitute the paragraph beginning at page 12, line 4, with the following.

-- The second method exercises control in such a manner that the value of pressure inside the chamber 14 is regulated to a fixed value (indicated by the dashed line B in Fig. 2) higher than the peak value of pressure outside the chamber 14, which varies as indicated by the solid line in Fig. 2. With this method, the value of the pressure inside the chamber 14 is kept constant and, therefore, it is unnecessary to frequently correct the optical characteristics of the projection optics unit 13. --

Please substitute the paragraph beginning at page 13, line 19, and ending on page 14, line 4, with the following.

-- Though the present invention relates to an exposure apparatus using an exposing light source that emits short-wavelength light such as the light from an F_2 excimer laser, it should be obvious that the invention can be applied effectively also to a photoresist of the type that cannot be used in an oxygen atmosphere and to a substrate coated with a such a photoresist. Furthermore, it goes without saying that the projection optics unit 13 can be applied effectively to any of a reflecting unit, [reflecting refraction] reflecting-refraction unit and refraction unit. --

Please substitute the paragraph beginning at page 17, line 9, and ending on page 19, line 7, with the following.

-- Fig. 5 is a conceptual view illustrating the overall system of this embodiment expressed according to an aspect different from that depicted in Fig. 4. In the earlier example, a plurality of user plants each having manufacturing equipment are connected by an external network to the

management system of the vendor that provided the manufacturing equipment, and information concerning the production management of each plant and information concerning at least one piece of manufacturing equipment is communicated by data communication via the external network. In the example of Fig. 5, on the other hand, a plant having manufacturing equipment provided by a plurality of vendors is connected by an outside network to management systems of respective ones of the vendors of these plurality of pieces of manufacturing equipment, and maintenance information for each piece of manufacturing equipment is communicated by data communication. This system includes a manufacturing plant 201 of the user manufacturing equipment (the maker of semiconductor devices). The manufacturing line of this plant includes manufacturing equipment for implementing a variety of processes. Examples of such equipment are exposure equipment 202, resist treatment equipment 203 and thin-film treatment equipment 204. Though only one manufacturing plant 201 is shown in Fig. 5, in actuality a plurality of these plants [are] <u>is</u> networked in the same manner. The pieces of equipment in the plant are interconnected by a LAN 206 to construct an intranet and the operation of the manufacturing line is managed by a host management system 205. The places of business of vendors (equipment suppliers) such as an exposure equipment maker 210, resist treatment equipment maker 220 and thin-film treatment equipment maker 230 have host management systems 211, 221, 231, respectively, for remote maintenance of the equipment they have supplied. These have maintenance databases and gateways to the outside network, as described earlier. The host management 205 for managing each piece of equipment in the manufacturing plant of the user is connected to the management systems 211, 221, 231 of the vendors of these [piece] <u>pieces</u> of

equipment by the Internet or leased-line network serving as an external network 200. If any of the series of equipment in the manufacturing line malfunctions, the line ceases operating. However, this can be dealt with rapidly by receiving remote maintenance from the vendor of the faulty equipment via the Internet 200, thereby making it possible to minimize line downtime. --

Please substitute the paragraph beginning at page 20, line 16, and ending on page 21, line 17, with the following.

-- Fig. 7 illustrates the overall flow of a process for manufacturing semiconductor devices. The circuit for the device is designed at step 1 (circuit design). A mask on which the designed circuit pattern has been formed is fabricated at step 2 (mask fabrication). Meanwhile, a wafer is manufactured using a material such as silicon or glass at step 3 (wafer manufacture). The actual circuit is formed on the wafer by lithography, using the mask and wafer that have been prepared, at step 4 (wafer process), which is also referred to as "pre-treatment". A semiconductor chip is obtained, using the wafer fabricated at step 4, at step 5 (assembly), which is also referred to as "post-treatment". This step includes steps such as actual assembly (dicing and bonding) and packaging (chip encapsulation). The semiconductor device fabricated at step 5 is subjected to inspections such as an operation verification test and a durability test at step 6 (inspection). The semiconductor device is completed through these steps and then is shipped (step 7). The pre- and post-treatments are performed at separate special-purpose plants. Maintenance is carried out on a per-plant basis by the above-described remote maintenance system. Further, information for production management and equipment maintenance is

communicated by data communication between the pre- and post-treatment plants via the Internet or leased-line network. --

IN THE CLAIMS

1. (Amended) An exposure apparatus having an illuminating optics unit for irradiating a reticle, on which a predetermined pattern has been formed, with exposing light emitted from an exposing light source, a reticle stage on which the reticle is placed, projection optics unit for projecting the predetermined pattern of the reticle onto a substrate, and a substrate stage on which the substrate is placed, said apparatus comprising:

at least one chamber for internally accommodating the illuminating optics unit, the reticle stage, the projection optics unit and the substrate stage;

first pressure control means for making pressure inside the [chamber] projection optics unit higher than pressure outside the chamber; and

first correction means for correcting optical characteristics of the projection optics unit in accordance with a value of pressure inside the [chamber] projection optics unit.

2. (Amended) The apparatus according to claim 1, wherein the reticle is irradiated with exposing light, which has been emitted by the exposing light source, via the illuminating optics unit, the predetermined pattern that has been formed on the reticle is projected onto the substrate via the projection optics unit to expose the substrate to the pattern, and the exposing light has an

optical path the entirety of which is sealed within said at least one chamber, said apparatus further comprising:

second pressure control means for making pressure inside [this] said at least one chamber higher than pressure outside [this] said at least one chamber; and

second correction means for correcting optical characteristics of the projection optics unit in accordance with a value of pressure inside [this] said at least one chamber.

4. (Amended) The apparatus according to claim 3, wherein the inert gas is selected from the group consisting of nitrogen gas, [or] helium gas [or] and a mixed gas of nitrogen gas and helium gas.

5. (Amended) The apparatus according to claim 1, wherein control is performed in such a manner that pressure inside [said chamber] the projection optics unit is made higher, by a fixed amount, than pressure outside the [chamber] projection optics unit.

6. (Amended) The apparatus according to claim 1, wherein pressure inside said chamber is made constant.

7. (Amended) The apparatus according to claim 1, further comprising a first pressure sensor for sensing the value of pressure inside [said chamber] the projection optics unit and a

second pressure sensor for sensing value of pressure outside [said chamber] the projection optics unit.

8. (Amended) The apparatus according to claim 1, wherein said first correction means estimates an amount of change in optical characteristics of said projection optics unit based upon an index of refraction, which varies in accordance with the value of pressure inside said [chamber] projection optics unit, and corrects the optical characteristics of said projection optics unit based upon the estimated amount of change in optical characteristics of said projection optics unit.

12. (Amended) A method of manufacturing a semiconductor device, comprising the steps of:

placing a group of manufacturing equipment for performing various processes, inclusive of [the] an exposure apparatus having an illuminating optics unit for irradiating a reticle, on which a predetermined pattern has been formed, with exposing light emitted from an exposing light source, a reticle stage on which the reticle is placed, a projection optics unit for projecting the predetermined pattern of the reticle onto a substrate, and a substrate stage on which the substrate is placed, [said] the apparatus comprising:

(i) at least one chamber for internally accommodating the illuminating optics unit, the reticle stage, the projection optics unit and the substrate stage;

(ii) first pressure control means for making pressure inside the [chamber] projection optics unit higher than the pressure outside the chamber; and

(iii) first correction means for correcting optical characteristics of the projection optics unit in accordance with a value of pressure inside the [chamber] projection optics unit, in a plant for manufacturing semiconductor devices; and

manufacturing a semiconductor device by performing a plurality of processes using this group of manufacturing equipment.

14. (Amended) The method according to claim 13, [wherein] further comprising obtaining maintenance information for [said] the manufacturing equipment [is obtained] by accessing, by data communication via the external network, a database provided by a vendor of [said] the manufacturing equipment or by a user, or production management is performed by data communication with a plant other than [said] the first-mentioned plant via the external network.

15. (Amended) A plant for manufacturing a semiconductor device, said plant comprising:

a group of manufacturing equipment for performing various processes, inclusive of [the] an exposure apparatus having an illuminating optics unit for irradiating a reticle, on which a predetermined pattern has been formed, with exposing light emitted from an exposing light source, a reticle stage on which the reticle is placed, a projection optics unit for projecting

the predetermined pattern of the reticle onto a substrate, and a substrate stage on which the substrate is placed, said apparatus comprising:

(i) at least one chamber for internally accommodating the illuminating optics unit, the reticle stage, the projection optics unit and the substrate stage;

(ii) first pressure control means for making pressure inside the [chamber] projection optics unit higher than pressure outside the chamber; and

(iii) first correction means for correcting optical characteristics of the projection optics unit in accordance with a value of pressure inside the [chamber] projection optics unit;

a local-area network for interconnecting the group of manufacturing equipment; and

a gateway for making it possible to access, from said local-area network, an external network outside the plant[;],

whereby information relating to at least one of the pieces of manufacturing equipment can be communicated by data communication.